



Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”

Mazdoor Kisan Shakti Sangathan

“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

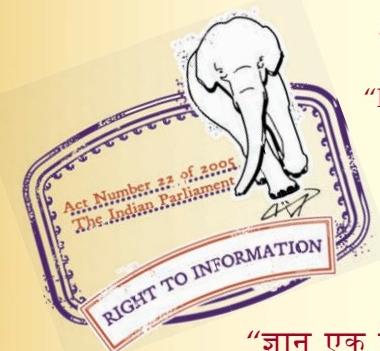
“Step Out From the Old to the New”

IS 8420 (2000): Grain Dryers - Glossary of Terms [FAD 20:
Agriculture and Food Processing Equipments]

“ज्ञान से एक नये भारत का निर्माण”

Satyanaaran Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartṛhari—Nītiśatakam

“Knowledge is such a treasure which cannot be stolen”



BLANK PAGE



PROTECTED BY COPYRIGHT

IS 8420 : 2000

भारतीय मानक

अनाज सुखाने के यंत्र — पारिभाषिक शब्दावली

(पहला पुनरीक्षण)

Indian Standard

GRAIN DRYERS — GLOSSARY OF TERMS

(*First Revision*)

ICS 01.020; 65.060. 01

© BIS 2000

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards after the draft finalized by the Agricultural Produce Processing and Milling Machinery Sectional Committee had been approved by the Food and Agriculture Divisional Council.

Various terms are commonly used in relation to grain dryers and drying. With a view to accord authoritative and uniform definitions to these terms, this standard has been formulated.

This standard was first published in 1977. This revision has been taken up to incorporate a number of new terms and to update existing terms in the light of comments received on the standard.

Indian Standard

GRAIN DRYERS — GLOSSARY OF TERMS

(First Revision)

1 SCOPE

This standard covers the definitions of various terms frequently used in relation to grain dryers and drying.

2 DEFINITIONS

2.1 Absolute Humidity — Absolute humidity is the ratio of mass of water and mass of air in a mixture of water vapour and air.

2.2 Ambient Temperature — The temperature of the surrounding atmospheric air.

2.3 Available Heat in Drying Air — The quantity of heat in drying air that can be utilized in evaporating the moisture from the grain.

2.4 Batch — Quantity of grain put into a bin or container on repetitive basis that can be held for drying.

2.5 Blending — The process of mixing two or more different products together, such as, grains and supplements, to obtain desired quality characteristics or of mixing different quantities of the same product with different moisture contents to obtain a final mass with a uniform moisture content.

2.6 Bound Moisture — The amount of moisture tightly bound to the grain interior with properties different from those of free moisture.

2.7 Bin Discharger — An equipment/outlet for discharging products from bulk storage bins.

2.8 Casing — The outer enclosure surrounding the entire heat exchanger and confining the air being heated.

2.9 Conduction — Transmission of heat through or by means of a conductor.

2.10 Control — Any component of a dryer or heat source designed to effect or limit any normal or abnormal conditions of the drying operation or control drying parameters in a desired way.

2.11 Convection

Transmission of heat by moving masses of matter, as by current in gases and liquids, caused by difference in density due to different temperatures.

2.12 Cooler — A self contained unit for cooling of dried but hot grains.

2.13 Cooling Stage — The time required to move a cooling zone entirely through a grain mass.

2.14 Cooling Zone — The portion or section of the grain mass front in storage where the temperature of the grain falls during aeration.

2.15 Cycling Burning — Type of operation wherein application of maximum heat is periodic, such as:

- a) cycling between high fire and low fire;
- b) cycling between high fire and a constant pilot; and
- c) cycling from high fire to off, then restarting to high fire by constant or intermittent ignition.

2.16 Dehydration — The reduction or lowering of moisture from grain/product usually to a very low level.

2.17 Depth Factor — When drying with air, a depth which would contain enough product that, if all the theoretical heat available for drying could be used, it would all dry to equilibrium in a period of time equal to time required for fully exposed grain to dry half-way to equilibrium.

2.18 Dew Point — Temperature at which a vapour condenses its first drop of liquid from vapour-air mixture. At this temperature the dry-bulb temperature equals the wet-bulb temperature.

2.19 Dielectric — A non-conducting material having few electrons of fixed polarity or charge.

2.20 Discharge Grain Temperature — The mean temperature indicated by a thermometer inserted in a sample of grain being discharged from the dryer.

2.21 Dry-bulb Temperature — The temperature of a vapour-air mixture ordinarily determined by using the thermometer.

2.22 Dryer — A unit which provides the conditions for reducing moisture, generally by forced ventilation with or without addition of heat.

2.22.1 Batch Dryer — A dryer wherein the product to be dried is placed in batches and drying is regulated by the length of time the whole batch is under treatment in the dryer. This can be portable or stationary.

2.22.2 Circulating Dryer — A batch dryer equipped to circulate or mix the product during drying or cooling period.

2.22.3 Continuous Flow Dryer — A dryer in which the material is moved through in a substantially continuous stream and its rate of progress regulated in order to adjust the capacity of the unit.

2.22.4 Counter-Flow Dryer — A continuous-flow dryer wherein the grain being dried move in one direction and the drying air moves in the opposite direction.

2.22.5 Cross-Flow Dryer — A continuous flow dryer wherein the flow of air is the transverse to the direction of flow of the product being dried.

2.22.6 Direct-Fired Dryer — A dryer in which the product of combustion comes into direct contact with the product being dried.

2.22.7 Indirect-Fired Dryer — A dryer in which the product of combustion does not come in contact with the product being dried and heat is transferred through heat exchanger.

2.22.8 In-silo Dryer — A silo or large bin in which usually large quantity of grain is stored is used for drying of grains by providing air heating and circulation arrangement and controls.

2.22.9 Parallel-Flow Dryer — A continuous flow dryer in which the drying air flows in the same direction as that of the grain being dried.

2.22.10 Self-Contained Dryer — The dryer unit consisting of the drying and/or cooling chamber, heat or radiation source, all fans and duct work alongwith the necessary controls and product handling equipment.

2.22.11 Tunnel Dryer — A dryer in which the grain being dried is conveyed through a tunnel like chamber. It may be continuous flow or batch type.

2.23 Drying — The reduction of moisture in a product usually to some predetermined moisture content.

2.24 Drying Air — The air being passed through the grain for drying.

2.25 Drying Air Temperature — The temperature of the air entering the grain being dried.

2.26 Drying Conveyor — A mechanical linkage or assembly to carry the grain being dried through the drying chamber.

2.27 Drying Front — The divisional layer between the dried and undried grains in drying systems with shallow drying zones.

2.28 Drying Zone — The band or layer of grain in a dryer in which most of the drying occurs at any instant.

2.29 Enthalpy — Enthalpy of air is defined as the heat content of a unit mass of dry air and its associate moisture.

2.30 Equilibrium Moisture Content — The moisture content of the grain when it is in equilibrium with the surrounding atmosphere.

2.31 Equilibrium Relative Humidity — The relative humidity of the air surrounding the grain which is in equilibrium with grain of a given moisture content. The air and grain are at the same temperature.

2.32 Evaporation — The total mass of moisture evaporated by the dryer per hour or per batch calculated from the input and output moisture content of the grain and the output mass of the grain treated; except in case of the batch or in-silo dryers.

NOTE — In batch or in-silo dryer there may be circumstances where the output moisture content is most accurately estimated by reference to the total loss of mass during drying. Also there may be loss of mass due to insect infestation if grain are stored for long duration.

2.33 Flow Control Valve — A check valve which permits flow of fluid in either direction but which limits excessive flow in one direction. If the designated flow rate is exceeded, the valve automatically closes.

2.34 Fail Safe Control — A control so designed that a malfunction of any of its components shall automatically stop the operation of the device or equipment controlled by it.

2.35 Fan — A device used to move air for drying, aeration etc. It includes blade assembly, mounting

structure and casing, but may or may not include a power source.

2.36 Free Moisture Content — Amount of moisture adhering to grain surface or mechanically entrapped in the void space of grain having nearly all properties similar to those of free water.

2.37 Hot Air Unit — A basic heated air producing unit including fan, burner and electrical system or any other type of complete heating system. It is usually coupled to drying structure by means of a flexible duct.

2.38 Heat Capacity — Heat capacity is known as the heat required to raise the temperature of a unit mass of a substance by a unit temperature.

2.39 Heat Exchanger — A device used to transfer heat from one fluid stream to another without intermixing.

2.39.1 Direct Type Heat Exchanger

In this type of heat exchangers, the hot flue gas is diluted with atmospheric air and the mixture is used for drying grains.

2.39.2 Indirect-type Heat Exchanger

Indirect-type heat exchangers are of two types. One is air to air heat exchanger, in which the air to be used for drying is heated by the flue gas in a shell-and-tube heat exchanger. The other is steam-to-air heat exchanger, in which air to be used for drying is heated in shell and extended surface (fin) heat exchanger using steam.

2.40 Hot Air Drying — Use of forced ventilation with the addition of heat for drying.

2.41 Hot Air Temperature — Mean temperature of the air to be used for drying the grain, measured at a number of points as close as practicable to its entry to the grain.

2.42 Holding Capacity — The amount of grain a dryer or a bin can hold. It is not necessarily the drying capacity or the throughput capacity of the dryer. For example, a continuous flow dryer may have a 6 tonne holding capacity, a 12 tonne throughput capacity and an average drying capacity of 2 tonnes per hour.

2.43 Humid Volume — Humid volume of a vapour-air mixture is the volume in cubic metres of one kilogram of dry air and its accompanying vapour at the prevailing temperature and pressure.

2.44 Manometer — U-tube filled with liquid to measure pressure in air duct systems.

2.45 Maximum Permissible Drying Time — The maximum elapsed time that may be used to complete drying any portion of the grain without undesirable change in grain quality.

2.46 Modulate — Automatically governing the rate of fuel flow by a control which is temperature sensitive in order to maintain a constant temperature at the location of the sensing device.

2.47 Moisture Content — Content of water in the grain expressed as percentage by mass on wet or dry basis, determined by using following formula:

$$\text{Moisture Content (Wet Basis)} = 100 \times \frac{\text{Weight of water in product}}{\text{Weight of dry matter} + \text{Water}}$$

$$\text{Moisture Content (Dry Basis)} = 100 \times \frac{\text{Weight of water in product}}{\text{Weight of dry matter}}$$

2.48 Pitot Tube — Special tube used in conjunction with a manometer to obtain air velocity in air duct.

2.49 Plenum Chamber — An air chamber maintained under pressure (positive or negative) usually connected to one or more distributing ducts in a drying or aeration system. The term is also used to designate the air chamber under the perforated floor in a grain bin and the pressure chamber between grain columns in a batch dryer.

2.50 Pressure Regulator — A device which reduces the fluid (liquid or gas) pressure to a relatively constant delivery pressure while inlet pressure and volume of gas may vary.

2.51 Pressure Relief Valve — A valve designated as a safety device to open and remain open, to discharge a fluid whenever the fluid pressure reaches the start-to-discharge setting of the valve. When the fluid pressure drops somewhat below this setting, the relief valve automatically closes.

2.52 Pressure System — Method of air movement in which the air is forced through the product with the air duct or ducts at a pressure about atmospheric pressure. It is called a 'pushing' or 'forcing' system of air movement.

2.53 Pre-ventilation — The cleaning of the plenum or duct of any volatile gases prior to ignition of the burner. It is usually accomplished by a device which ensures that the fan is operating for a certain period of time before ignition is permitted.

2.54 Psychometric Chart — The various properties of air and air-water vapour mixture represented in a graphic form.

2.55 Quick Acting Valve — A manually-operated valve specially designed to accomplish rapid shut-off of fuel flow to dryer.

2.56 Radiation — Transmission of heat without the help of intervening media.

2.57 Relative Humidity — Relative humidity of a vapour-air mixture is a measure of its fractional saturation with moisture and is defined as the ratio of the partial pressure of the vapour to the saturated pressure at the same temperature.

2.58 Specified Ambient Conditions — The ambient conditions of temperature, pressure and relative humidity to which the results of a dryer may be corrected.

2.59 Specified Energy Consumption — The consumption of energy for evaporating one kilogram of water including the heat equivalent of all power used by the dryer corrected to specified ambient conditions.

2.60 Specified Evaporation — The mass of water evaporated per unit of fuel, corrected to specified ambient conditions.

2.61 Static Pressure — The pressure exerted by a static fluid medium on the wall of the container.

2.62 Steady State — Condition when the operation or process reaches equilibrium.

2.63 Suction System — Method of air movement in which the air is moved through the product with the air duct or ducts at a pressure lower than atmospheric. It is also called exhaust system of air movement.

2.64 Supplemental Heat — Any heat added to that already present in the atmosphere to obtain a limited temperature rise to accomplish drying within the maximum permissible drying time to prevent spoilage.

2.65 Temperature Rise — The difference between ambient temperature and the temperature of the drying air resulting from the addition of heat by dryer burner.

2.66 Tempering — Bringing a product to a desired moisture content or temperature for processing. The

term also applies to equalization of moisture or temperature throughout kernel or grain.

2.67 Throughput — The amount of grain which can flow through a continuous flow dryer per unit of time.

2.68 Time of Drying — The elapsed time from the start of the drying process to the point of achieving desired moisture content of product.

2.69 Time of One-Half Response — Time required to dry fully exposed grain half way to equilibrium.

2.70 Traverse Time — The in-product travel time of air from entrance to any point.

2.71 Turning — The process of moving grain through the air within a bin or storage structure or from one bin or structure to other.

2.72 Unbound Moisture — Moisture in excess of equilibrium moisture content corresponding to saturated humidity.

2.73 Vapourizer — A type of heat exchanger wherein heat is supplied to change the liquid fuel to vapour ready for combustion. The vapourizer may be integral with the burner so that part of the heat of combustion is used for vapourization.

2.74 Vapourizer Burner — An integral unit dependent upon the heat generated by the burner as the source of heat to vapourize the liquid fuel.

2.75 Velocity of Air Flow

2.75.1 Apparent Velocity of Air Flow

The rate of air flow determined by dividing the quantity of air flow by the cross-sectional area.

2.75.2 Average Velocity of Air Flow

The rate of air travel through product void space. it is determined by dividing the apparent velocity by the product void space.

2.76 Void Space — The space between the particles in a bulk of stored grain usually expressed as percent of total volume.

2.77 Wet-Bulb Temperature — This is the steady temperature reached by a small amount of liquid evaporating into a large amount of rapidly moving unsaturated vapour-air mixture.

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act, 1986* to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publications), BIS.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

This Indian Standard has been developed from Doc : No. FAD 51 (937).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters :

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110 002
Telephones : 323 01 31, 323 33 75, 323 94 02

Telegrams : Manaksantha
(Common to all offices)

Regional Offices :

Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg
NEW DELHI 110 002

Telephone
 $\left\{ \begin{array}{l} 323 76 17 \\ 323 38 41 \end{array} \right.$

Eastern : 1/14 C. I. T. Scheme VII M, V. I. P. Road, Kankurgachi
CALCUTTA 700 054

$\left\{ \begin{array}{l} 337 84 99, 337 85 61 \\ 337 86 26, 337 91 20 \end{array} \right.$

Northern : SCO 335-336, Sector 34-A, CHANDIGARH 160 022

$\left\{ \begin{array}{l} 60 38 43 \\ 60 20 25 \end{array} \right.$

Southern : C. I. T. Campus, IV Cross Road, CHENNAI 600 113

$\left\{ \begin{array}{l} 235 02 16, 235 04 42 \\ 235 15 19, 235 23 15 \end{array} \right.$

Western : Manakalaya, E9 MIDC, Marol, Ar. theri (East)
MUMBAI 400 093

$\left\{ \begin{array}{l} 832 92 95, 832 78 58 \\ 832 78 91, 832 78 92 \end{array} \right.$

Branches : AHMADABAD. BANGALORE. BHOPAL. BHUBANESHWAR. COIMBATORE
FARIDABAD. GHARIAKABAD. GUWAHATI. HYDERABAD. JAIPUR. KANPUR.
LUCKNOW. NAGPUR. PATNA. PUNE. RAJKOT. THIRUVANANTHAPURAM.